Creativity and Innovation in Science and Technology – Bridging the Gap between Secondary and Tertiary Levels of Education in Mauritius

Introduction

The government decision to open access to tertiary education to 100,000 international students by 2025 (Strategic Paper, 2013-2025) is indeed a daunting task although not an impossible one. Mauritius, an island state which does not have any natural resources, has been struggling to keep and maintain a high status (The Guardian, 2011) in the continent. Its human resources are the key agents which, until now, have been the determining factor for Mauritius to be one of the most flourishing economies in the region. The education system is expected to change to be able to address the requirements of the new technology-savvy generation. For learning to be meaningful, the integration of technology in education has to be realised within a dynamic paradigm to allow updates to be effected progressively. The extent to which the secondary and tertiary sectors have brought about appropriate adjustments in the way teaching and learning take place is what will be investigated in this study. Any changes happening in society inevitably impact on life processes in society and the search and development of new approaches are part of the normal process of a dynamic society.

Problem Statement

This paper thus focuses on a study conducted with a sample of teachers and students at secondary and tertiary levels with a view to answering the following research questions:

- Is there a gap between the secondary and tertiary levels of education in teaching and learning and, if so, to identify the extent of the existing gap, particularly in Science and Technology education?
- Does the existence of the gap, if any, impacts upon students' creativity and innovativeness at university level?

Students who are following courses in science, mathematics and technology have been targeted as the sample population. In addition, the term 'gap' is used to identify whether the processes occurring at the secondary level of education allow students to operate in such a way so as to develop creativity and become innovators.

Theoretical Foundation

The dynamism prevailing within a society depends significantly on the innovativeness of its population, as well as their ability to create knowledge that contributes to the welfare of society (Meek *et al*, 2009). Schools have a crucial role to play in developing students' critical mind that would allow them to see and interpret things differently and thus be creative. Creativity and innovation are closely intertwined and are the basis of any developments in society.

On one hand, innovation can contribute to develop a sense of responsibility in learners in addition to making them become responsible and active citizens (Shapiro *et al*, 2007). On the other hand, creativity which includes 'assimilators' and 'explorers' (Martinsen, 1995) is essential for the mind to become producers of knowledge (Houtz and Krug, 1995). Creativity is also seen as the building block for innovation. Innovation without creativity leads to a situation where only technicians are produced and not visionaries. Visionaries are creative people who make things out of nothing (Handy, 1999) but the development of creativity

needs to have a social dimension as well as a contextual perspective (Csikszentmihalyi, 1988; Drazin et al., 1999; Beyer, 1984; De Bono, 1983). Vygotsky clearly emphasises the social dimension in knowledge construction by learners (Daniels, 2001). The interaction in a social set up and the use of language are determining factors (Vygotsky, 1978) in the development of a critical mind. By providing opportunities for learners to express themselves freely and to challenge different points of view, they are able to break down the barriers that exist between disciplines and subject areas (Johansson, 2004).

The authors posit that in Mauritius, although the National Curriculum Framework (2009) highlights an integrated approach to teaching and learning, it is not being put in practice at school. Furthermore, an integrated approach, as clarified by Johansson (2004), is essential in knowledge construction, while rote learning concepts, strategies and procedures is a wasteful undertaking since the working memory has, unfortunately, limited capacity (Tarmizi & Sweller, 1998; Sweller et al., 1990). Sweller (1988), introduces the cognitive load theory to explain how valuable instructional resources can encourage learning during activities that are pertinent to schemata acquisition.

College (Parmessur *et al*., 2003) and university (Carre, 1981) students are still resorting to rote memorisation to learn concepts in a passive way and this would severely impinge on their abilities to develop creativity and eventually become innovators. The development of a critical mind through critical thinking is the determining factor to creativity and innovativeness. Mauritius has placed higher education as a top priority in a bid to leapfrog into tertiary education – an endeavour to ensure that the island becomes a competitive partner. With a laudable initiative, the target of which is to have one graduate per family, a review of the educational system, both at secondary and tertiary levels, should be a priority.

Methods

The research project was undertaken as a survey employing both the qualitative and quantitative methods. The quantitative data were obtained by means of student and teacher questionnaires. Semi-structured interviews were conducted to triangulate the data.

Participants

There were a total of 27 participants, including students from two local universities as well as trainee teachers (graduates) from the teacher training institution. The university students came from three different faculties, and who were either still following the undergraduate course or had recently completed their studies. The fields of study of these students were mainly Information Technology, Food Science, Mathematics and Biology. Three of them were first year students while five were in their third year and the remaining having just completed their undergraduate course. From the 30 participants who had been invited to participate only 17 had responded positively. 10 post-service physics trainee teachers undertaking the Post Graduate Certificate in Education (PGCE) at the Institute of Education were also involved at a later stage.

Data collection

Surveys and interviews were conducted in order to explore the students' views and perceptions about their experiences in secondary schools and at university. Classroom observations were carried out in secondary schools to gain an insight about classroom practices, and the researchers' comments and reflections were noted in an observation log. The researchers had to engage themselves in the observation of three physics lessons at

secondary level to help them design the questionnaire and formulate their interview questions. The authors felt the need for a solid grounding of the classroom transactions before embarking on systematic data collection.

Two semi-structured interviews, which were video recorded, were organised independently with 6 students from the local universities and 10 trainee post-service teachers undertaking their PGCE course at the Institute of Education.

Surveys

Student Questionnaire

A questionnaire was administered to 17 university students. It consisted of 21 questions and participants were invited to provide information on the following broad categories based on their knowledge and experiences:

(a) personal background information
(b) counselling facilities
(c) appreciation of the faculty
(d) choice of subject related to science and technology
(e) understanding of critical mind
(f) motivation to pursue further studies
(g) understanding of innovation
(h) weaknesses of the present educational system

The questionnaire was pilot tested with a sample of three students and minor modifications were brought to items (e) and (f) to relate it to their modules.

Teacher Questionnaire

A questionnaire was administered to 16 post-service trainee teachers. It consisted of three open questions to capture the processes within the teaching-learning environments. The following questions were set:

(a) What strategies do you adopt in teaching science concepts?
(b) Does the way you teach help students develop a critical mind?
(c) According to you, what are the determining factor(s) for a student to develop creativity?

The questionnaire was pilot tested to enhance validity with a sample of three trainee teachers and question (b) had to be rephrased from 'To what extent your teaching is helping students develop a critical mind?' to the present one, as the response was too diverse. Moreover, 'innovative' was dropped from question (c) as the respondents were confusing 'creativity' with 'innovation' and vice versa. These questions were set to obtain a broad perspective from the teachers about the teaching-learning transaction and also to situate the extent to which students' voice was being considered (Raihanah & Mary-Ann, 2010). The questions were developed following what had been observed during the classroom observation sessions.

The findings from the teacher questionnaire have been analysed individually, but infused in the discussions that follow.

Semi-structured Interviews

A group of 6 students from the two universities and 10 post-service trainee teachers (physics) from the teacher training institution were interviewed in two different interview sessions.

Table 1 illustrates the gender breakdown.

Table 1: Gender breakdown

University X (Faculty of Science)		University Y (Faculty of Technology)		Teacher Training Institute	
Male	Female	Male	Female	Male	Female
2	1	2	1	5	5

None of the participants objected to the interview being video recorded. The semi-structured group interview with the university students was deemed necessary to triangulate and validate the data obtained from the questionnaires. This interview took place in the conference room of one of the faculties of the teacher training institution and lasted for 48 minutes. The students (university) were briefed about the objectives of the interview and they were told that everything they would say would help the researchers to better situate the difficulties that students encounter both at secondary and tertiary levels. There is a need to highlight that approval to carry out this study was sought at the level of faculties, and it was clearly explained that nothing compromising would be raised. The students were clearly explained about the purpose of the study and they were offered the opportunity to withdraw from the process of data collection at any time, if they wished, but none did. Moreover, the three students from one of the universities had already been graduated and students from the other university and teacher training institution were invited through their faculties. This study was mostly geared at identifying mismatches from the point of view of the students and trainees. The semi-structured interview with the 10 trainee teachers was mostly oriented at (a) the strategies they use to teach concepts, (b) the classroom dynamism and (c) their constraints. It has to be highlighted that these three areas do cut across the open questions that had been set in the teacher's questionnaire. The interview took place in the physics laboratory of the teacher training institution and lasted for 51 minutes. At the very start, the teachers were briefed about the objectives of the interview and they were also offered the opportunity to withdraw if they wished to. They (both groups) were given the assurance that the video recording would be deleted once data collection would have been completed. No one withdrew during the course of the interview and the interviewees displayed keenness to answer the questions. The findings from the interview of the trainee teachers were used exclusively to triangulate the data obtained from the questionnaires and from the interview of the students.

Data Analysis & Discussion

Questionnaire & Interview

Tables 2-6 illustrate the responses of the students in relation to five of the six categories, namely counselling facilities, appreciation of the faculty, choice of subject related to science and technology, development of a critical mind, motivation to pursue further studies, transition from secondary to tertiary level. The background information, which constituted the first category, has helped the authors to make the appropriate selection of students for the interview.

Counselling facilities

Table 2: Counselling facilities

	Number			Percentage (%)	
	Yes	**No**	**Total**	**Yes**	**No**
Are you aware of existing career counselling facilities at the Ministry of Education & HR?	14	3	17	82	18
Did you take advantage of such facilities?	7	10	17	35.3	64.7

Gathering from Table 2 above, it is quite surprising to note that the majority of the students (64.7 %) did not take advantage of the existing career counselling service that the Ministry of Education & Human Resources was offering, though most of them were aware of the existence of such a service. At the very outset of career identification, the students did not show any interest in what our tertiary institutions were offering to better prepare their entry in the domain of tertiary education. This free counselling service, offered anytime on request, is crucial in helping students to choose the appropriate subjects/course, since it would have enabled the students to make wise educational, personal and social decisions (Egbochuku, 2008), which in turn have a direct impact on their future career orientations. This career service offers guidance to students across various domains, such as career guidance, careers information, career education activities in schools – including choice of subjects, establishing contacts with employers and training providers (MoEHR). Students have the possibility to have access to a number of such services through their schools on request.

During the interview with the trainee teachers, the latter confirmed that they do not usually highlight the importance of the counselling service to students. They felt it was the responsibility of the parents to advise their children about such counselling programmes. This is in stark contradiction with what Hecht *et al.* (1999) uphold about teaching which should not just be activities happening in the classroom only. It is unfortunate to mention that collaboration among the various stakeholders, if existent, does not concur and operates in disjunction with each other. Counselling, done at an early stage of secondary schooling, may act as a catalyst to ignite students' determination to follow a specific course of action.

In the course of the interview with the students, four out of six students confirmed that during their secondary schooling they did not find it necessary to attend such sessions and that they would 'cross the bridge' when the time comes. The two students who opted for the service clarified that their choice of subjects was largely determined by what they had learnt in those sessions. Most of the teachers also confirmed that they did not advise the students to seek the help of counsellors as they were more preoccupied with their teaching and completing their 'lessons plans' for the next day and they felt that such a task was, above all, the parents' responsibility.

One student (S1) claimed that:

> *Our parents have talked to us about what field to choose when I was in secondary schools but at a later stage. I would have preferred that they motivated me since I joined secondary school.*

Another student (S4) added:

I think that the approach in choosing which field to study should come well earlier and probably this would have helped me to develop a critical mind much earlier.

Motivation plays a very important role in so far as it contributes to achievement, but also because it is in itself an outcome (Ames, 1990). In order for students to develop motivational thought patterns, Ames (1990) claims that the quality of engaged time is a critical element. In such a situation, the collusion between parents and teachers may enhance self-confidence in the student. Moreover, Jeynes (2007) maintains that when this collaboration exists, 'the students succeeded both academically and socially' (p. 55). Such a collaborative relationship should be developed within an appropriate framework which captures a move from logical to cooperative and finally collaborative (McCarthy *et al.,* 2007).

The discussion that took place in the interview enabled the authors to gain an insight into the thinking of the students. The students' views were mostly oriented at performance rather than at their holistic development as promulgated by the National Curriculum Framework (2009). The authors felt that that Framework was an alien document for both the teachers and students as reference was made to the syllabus (content) only rather than to the process leading to purposeful knowledge construction and development of a critical mind. This brings in a paradoxical situation whereby teachers remain 'limited to the correct application of what has been developed by these specialists' (Carl, 2005, p.223), when not involved in the curriculum development process, but when involved (as in the case of the NCF, 2009), they still remain the *receiver.*

Appreciation for the faculty

Table 3: Appreciation for the faculty

	Number			**Percentage (%)**	
	Positive Response	**No Response**	**Total**	**Positive Response**	**No Response**
What did you like most about the Faculty/University?	15	2	17	87	13
What did you like least about the Faculty/University?	15	2	17	87	13

With regard to their appreciation for their faculty, 87% of the students claimed they appreciated their respective faculty lecturers. However, during the interview all the students brought out that for them a good lecturer is one who would be giving them notes as was the case when they were studying in secondary schools. Some of them even expected to be offered support from the laboratory technicians when undertaking work on their dissertations. Such a near rote mode of learning (Novak, 2002) leads to situated cognition (Brown *et al*., 1989) where the learner is trapped into limited transfer of knowledge, while such an approach is confirmed by Kember (2002) to bring low-academic outcomes. Moreover, the students acknowledged that the course was too theory-laden and their margin for critical thinking was limited. Such an approach to 'learning' has its root set well back in primary school where "Significant stress and pressure were imposed on children as well as their parents and thus private tuition became a necessary evil" (Seebaluck and Seegum, 2012, pg 451). At all levels of education, students have been used to receiving lecture notes that even when they are encouraged to source information on their own, their bias towards teachers notes still prevail.

One student (S3) highlighted that:

> *The modules themselves are too theoretical and little space remains for the application of the acquired knowledge in specific contexts.*

Nowadays, the development of skills alongside theory is an important element to be able to create and innovate in the field of interest. Moreover, business firms in one of the Small Island States claimed that lack of skills and education of workers was a serious obstacle for competitiveness (Martin, 2011) and that the education systems are not preparing graduates sufficiently to enter the job market. 'Spoon feeding' in the education system is a severe deterrent to creativity and innovation, and as students become more dependent on teachers, such learner identity development has a negative effect on academic achievement (Berger, 1998; Berzonsky, 1989). The cut-throat competition at primary and then at secondary levels of education is to be blamed for such a situation.

Another student (S5) explained that:

> *At the secondary level, the only thing I knew was competition and I brought the same mind-set in tertiary also. It's me and not you.*

During the interview, the trainee teachers also confirmed their preference for the traditional approach and because of time constraints, which they identified as the main reason for which they opt for such an approach; however, they were unable to clearly explain the extent to which time is really a predominant factor in the teaching-learning process. Moreover, when confronted with whether they have a notion of the requirements of the National Curriculum Framework (NCF, 2009), none of them could respond. However, they acknowledged that the NCF should have driven their approach to teaching and learning, given that teachers are also partners in the process of curriculum change that started well back in 2005 and implemented as from 2009. Carl (2005) rightly claims that the involvement of teachers in curriculum matters, whether it is at conceptualisation or implementation stage, given it is of utmost importance for contextualisation purposes.

Choice of subject related to Science and Technology

Table 4: Choice of Subject

	Number			**Percentage (%)**	
	Science & Technology	**Non-Science**	**Total**	**Science & Technology**	**Non-Science**
What program did you choose/ complete?	8	8	16	50	50
Did the program match your career aspiration?	8	8	16	50	50

Note: 1 questionnaire was not answered for this particular part.

In relation to the choice of subject, 50% of the students indicated that they had not opted for a Science or Technology course as their first choice. During the interview, the students explained that it was due to their inadequate Higher School Certificate results that they did not get admission on the course they had selected first. This definitely has an adverse effect on the abilities and performances of students as emphasised by Edwards & Quinter (2011). The choice of the subject becomes one of the demotivating factors in hindering students from being creative and eventually developing an innovative mind. Moreover, during the

interview, the students claimed that there is merely any connection between what they have been studying and the job market and that they would wish to have on the job placement in industries and other areas as part of the undergraduate programme. There is a need to highlight that Small Island Developing States (SIDS) face a number of salient problems and that partnership between the public and private sectors in relation to tertiary education is an important element (Bray, 2011). The move to seek the collaboration of the private sector has already been initiated, exemplified with the inclusion of the *ICT Skill Development Programme* (*Le Matinal*, 2011); however, the need to establish a partnership structure remains a necessary endeavour.

Our education system is so examination oriented, starting right at the primary level that a cut-throat competition (Seebaluck and Seegum, 2012) is 'unofficially' established. Students are forced to learn concepts by heart, while schools are more interested to complete the syllabus rather than helping students to become creative and innovative. Such a view is shared by Trifoni and Shahini (2011) who claim that examination results, however valid and reliable cannot be the determining factor for determining students' competencies.

Development of a critical mind

Table 5: Developing a critical mind

	Number			**Percentage (%)**	
	Yes	**No**	**Total**	**Yes**	**No**
Were you able to develop a critical mind during your stay at the university?	16	1	17	95	5
Do you feel empowered to face coming challenges w.r.t job prospects?	16	1	17	95	5

The survey shows that 95% of the participants were of the view that they have developed a critical mind during the course of their study but during the interview, it was noted that both the groups of students and the trainee teachers associated 'a critical mind' with grades in examinations/assignments rather than to a way of thinking. The interview with the students also revealed a few surprising facts, amongst which, rote learning still being common practice among them. In other words, their secondary school experiences still very prominent determined their expectations at tertiary level, namely in terms of spoon feeding. A critical thinking perspective expects that schools and universities adopt a learner centered approach and this demands a shift in mindset from both the educators and the students (Raihanah & Mary-Ann, 2010). Yoder and Hochevar (2005) found out that when students are engaged in active learning, as compared to the lecture mode they display better cognitive outcomes and with less variably. On the other hand, Michel, Carter III and Varela (2009) clarify that "it does not appear that the active learning approach is superior to passive learning when success is measured by broad cognitive outcomes (pg. 413). During the interview, the students highlighted that they had group discussions only when it came to working on their assignments and that they would refrain from giving ample details on certain areas for fear that their friends would pick up their ideas. This type of attitude developed right from primary level, during the 'rat race' situation (Seebaluck and Seegum, 2012) has persisted throughout their schooling, so that they cannot function otherwise.
Student S3 claims that:

> *It's very difficult to operate in groups because we have not been involved right at start and this idea of competition is prevalent in everything that we do.*

Student S4 explains that:

> *If my friend in the group is not sharing, then why should I share? I have seen that I get better grades on my assignment while working alone and the output is better.*

Another quite surprising issue relates to the students' lack of independence. Indeed, all the students claimed that they still enjoy being dependent on their parents in terms of waking them up in the morning, making their bed or preparing their breakfast. The students acknowledged that the development of a critical mind demanded that they had to review their mindset by doing things differently. They also highlighted that they have been learning science and technology modules by rote and that they have now understood the consequences of their action.

Gathering from the above, we are of the view that the development of a critical mind should not be perceived to happen at school or university but in everything that one does and that critical thinking should be nurtured at all levels to avoid mismatch between acquisition and expectation. The students admitted that during most part of their studies, they were not very confident and they tended to rely mostly on lecturers. This is in line with Patel (2003) who confirms that confidence is one of the determining factors for students to become independent learners and adds that they 'should be encouraged to develop a voice' (Raihanah & Mary-Ann, 2010, p. 473). It is interesting to highlight that such a voice is developed in learners at the pre-primary level, but fades out as learners move on to primary and secondary levels.

The trainee teachers also confirmed that because they do everything for the students, the latter tend to expect everything to be done by the teachers. They also acknowledged that if they were to bring change in their way of operating, the students and even parents would start criticising them and they would not be considered as a 'good teacher'. They further added that a 'good teacher' is one who gives notes.

Moreover, during the interview, we noticed that the students were of the view that although group work is an important component in university programmes, they refrained from engaging themselves in extra-curricular activities which required group involvement. Unfortunately, group work is not assessed and is optional and highly recommended for the students to be engaged in. At the same time they agreed that such type of collaborative work would have developed their critical mind. Furthermore, they would also expect in future to have extra-curricular activities to form an integral part of academic programmes where they would be required to collaborate actively. However, faculty should be cautious at getting students to collaborate within a formal set up as Huang and Carroll (1997) explain that they had to adopt a flexible approach and to allow free participation of students in collaborative work.

Motivation to pursue further studies

From the questionnaire, 82% of the students claim to be willing to opt for higher studies. During the interview, the students highlighted that although they had been very eager and motivated to join tertiary education, their motivation gradually faded away as they could not display the required level of creativity and innovation. Goffnett *et al.* (2013) consider

intrinsic and extrinsic factors as determinant for career choice. The students' decline in motivation results from the fact that the extrinsic factor was not present. The questionnaire and interview revealed that the students had been motivated to pursue further studies given that they could not get jobs after graduating from their first degree. In such circumstances, the students had chosen to embark on a higher level degree programme, with the expectation that they would then get a job after its completion.

Transition from secondary to tertiary level

Table 6 illustrates students' understanding concerning transition from secondary to tertiary level.

Table 6: Transition from secondary to tertiary level

	Number			**Percentage (%)**	
	Easy/Yes	**Difficult/No**	**Total**	**Easy/Yes**	**Difficult/ No**
How did you find the transition from secondary to tertiary level? (This question has been grouped as Easy/Difficult)	8	8	16	50	50
Do you think secondary education was of any help for this transition? (This question has been grouped as Yes/No)	8	8	16	50	50
(For the question below, the various answers have been categorised as +ve and –ve)	Positive	No response	Total	Positive	Negative
Can you think of any innovative approaches at secondary level which could have helped make this transition smooth?	2	15	17	11.8	88.2

From the questionnaires, 50 % of the students stated that they had undergone a smooth transition from secondary to tertiary level. However, during the interview, they highlighted that the first year was truly challenging and shocking as they were not prepared to face such a drastic change. The interview also revealed that the transition was not as smooth as they would have expected. They mentioned that there is a world of difference between secondary and tertiary but admitted that if they had developed a critical mind during their secondary education, the transition would have been easier. They were expected to display a number of skills, such as creativity, independence or even innovation to be able to construct knowledge at tertiary level, and since they had not developed same at secondary level, it was a severe handicap to learn higher order concepts as a result. During the interview, all the students and even the trainee teachers (during their studies at tertiary) acknowledged the fact that they tended to keep the passive way of learning. Modell (1996) provides an explanation to such type of attitude and explains that a change in the classroom dynamism can only occur if both the faculty and students are willing to do so. The author adds that students have been so much involved in passive learning during their school vocation that they have "become adept at organising information in formats that are conducive to memorisation" (p. S70). Moreover, for the success of engaging students in active learning, negotiation of a common outcome is needed among the faculty and students.

One of the students (S6) pointed out that:

> *…the course I'm following, it concerns more the knowledge, but concerning the hands-on, I won't be able to do anything…the problem with the module is that we just learn* [knowledge] *and the facilities are not there* [application].

The unavailability of adequate infrastructure and facilities makes the course become more knowledge oriented rather than skills oriented, which would have been pertinent to understanding and knowledge construction that would thus have led to creative thinking (Zirbel, 2004) and innovation.

Student S2 added that:

> *When you do something using a virtual programme, it's not same as doing it in real life.*

This is discussed by Lunce (2006) who says that in situations of situated learning, it is important that an appropriate methodology be adopted to generate many learning outcomes with a view to making the virtual experiment as close as possible to real life situations. A virtual programme may become monotonous and unchallenging if it has as targets a single learning outcome.

However, the transition from secondary to tertiary was not that easy and the same students (50 %) maintained that the secondary education had not been of any help. These figures are quite alarming because the competitive attitude reinforced (Grubb, 2003) at secondary level is at the expense of skills development. As a result, this is putting increasing stress on the system so that students (88.2% - Table 6) are no more being engaged in knowledge construction to develop a critical mind since secondary level. The interview also confirms that the transition has been quite hard for the students as student S1 explained (a view that was shared by everyone else):

> *I would have preferred to have done things differently at secondary level so that it would have been easier for me at tertiary level. Unfortunately I was expecting too much from my parents and teachers. Now I understand.*

Limitations

First, only three institutions were involved, with a small sample of students, so that the findings cannot be generalised. Another limitation is that individual interviews could have provided more in-depth information. Moreover, gender is a variable that has not been taken into consideration and which could be incorporated in a future studies.

Recommendations

This study has revealed a number of salient issues related to the gap existing between the secondary and tertiary levels of education in the country, with special bearing on creativity and innovation in Science and Technology. The following recommendations are proposed to enable students (at secondary and tertiary levels) to develop creativity and hopefully become innovators.

Teachers should become partners in the curriculum development process by providing regular feedback to authorities and by developing a good understanding of the requirements

prescribed by the National Curriculum Framework (NCF). This will, in turn, enable them to develop an adequate understanding that teaching is not just a matter taking place in schools, but includes all the facets of the school-home partnership. Teaching and learning should go hand in hand as change can only occur if the teacher takes up a proactive role in the teaching-learning transaction. Moreover, teachers' engagement in continuous professional development programmes should become a policy decision.

There is a serious need to reflect on the type of education that our children should receive at secondary level. All students should be able to study at least one science subject till Higher School Certificate level rather than avoid the science stream as early as 14-15 years. Science, being a practical subject, would help students engage in investigations using the scientific method and construct knowledge. This means that the learner-centered approach, as prescribed by the NCF at the secondary level, should be adopted gradually to provide ample space for reflection and improvement and also to allow students breathing space for change. To be able to operate in today's hectic life, the need for a critical mind, a mind which can process information based on implicit and explicit factors is the key to face the incoming challenges.

The career guidance service offered by the Ministry of Education and Human Resources would have to be made explicit to students at the level of individual school. Insightful manuals would significantly help in the process.

Formative assessment should constitute a significant weightage in the assessment of understanding and skills at secondary level, in order to enable students to learn through interaction rather than through rote. The development of a critical mind should start at the secondary level, if not at the primary level itself.

Parents have a primordial role to play in the education of their children. They should provide the appropriate space for their children to become independent by undertaking certain household tasks on their own. Parents can also act as counsellors to advise their children on job prospects and career orientation.

University students should be intrinsically prepared to display independence in all facets of their lives when pursuing tertiary education (and even at the secondary level), and to behave as young adults, rather than heavily rely on their parents. The development of a critical mind, leading to creativity and innovation, also calls for students to develop a sense of pro-activeness, collaboration and sharing.

Conclusion

In an era of globalisation, the present education system does not respond to the upcoming threats that Small Island States would have to experience. SIDs are very vulnerable to socio-economic challenges and our survival is dependent on how creative and innovative we are. Because of the complex and dynamic nature of the job market, a paradigm shift in the education system will bring a breath of fresh air to our human capital. The only resources that we have are human resources and filling the loopholes will certainly bring a new dimension to how secondary and tertiary education should evolve.

This study has enabled us to document the 'voices' of teachers at the secondary level, graduates and students at university level and to show a mismatch between processes occurring at the secondary level and tertiary level. This gap between the secondary and tertiary levels of education and impinges significantly on learners' abilities to develop

creativity. For the first time, in 2009, a National Curriculum Framework has been developed to promote a sound and holistic development of the child and to help engender creativity and achievement. It is of paramount importance that teachers adopt a somewhat different role from that of a transmitter of knowledge to that of a facilitator and counsellor to engage learners in assuming role of responsibility. Engaging learners in a self-regulated learning (Zimmerman, 1990; Zumbrunn, Tadlock and Roberts, 2011) environment at an early age can only be beneficial to the learners themselves and to the society at large. There is a serious need for a change in mindset of both teachers and learners for the latter to understand that becoming independent in their way of thinking and operating will open new avenues in the construction of knowledge and development of skills in a dynamic and fast evolving technological world. The teaching and learning of science and technology in secondary schools should be within a learner centered paradigm to keep on challenging exiting conception of learners to be able to become independent scholars. Fortunately, Mauritius, being a small island state, has not endured the harsh economic recession that many countries are still experiencing until now. However, this does not mean that we are secured from another future economic crisis. We need a competent workforce which will generate innovative strategies to address problems that we are currently facing. We should not all the time be tempted to borrow or adapt solutions from other countries, we should be in a position to 'think out of the box' an innovative way and solve our own problems. Our future lies in the way our younger generation understand the challenges and is able to work creatively towards overcoming them.

Finally, all the stakeholders involved (parents, teachers, students, governmental and non-governmental agencies) should be prepared to take up this challenge for the benefit of our future generations.

Further Research

The findings from the data generate avenues for further research in exploring whether there is a gender variance in the transition from secondary and tertiary levels of education.

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